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Keywords: clusters, developing countries, Asia, innovation policy.

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INNOVATION POLICY FOR ASIAN SMEs: EXPLORING CLUSTER DIFFERENCES

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Abstract

Clusters are considered an adequate tool for development by governments and international organizations. Existing literature assumes that cluster policy can be universally applied & that industries cluster in similar ways. By comparing clusters in Asia, we highlight significant industrial differences in the relative importance of the cluster soft and hard infrastructure. We show the importance of the local specificities, the influence of national and regional policies & differences in upgrading strategies for SMEs. We identify patterns across industries and draw policy recommendations.

1. Introduction

Recently development studies have witnessed a surge of interest in clustering of industrial activities as means for supporting innovation and thus generating economic growth in developing countries (Bell and Albu, 1999, Giuliani et al, 2005, Marjolein et al, 2003). Despite its critics (Martin and Sunley, 2003, Markussen, 2003, Malmberg and Power, 2003, Benneworth and Henry, 2004) the cluster concept has proven to be a useful *hermeneutical device* (Yeung forthcoming) for identifying geographical concentrations of industrial activities, analyzing the consequences of clustering for innovation and economic development in developing countries (Bair and Gereffi, 2001, Pietrobelli and Rabelotti, 2004, Giuliani et al, 2005 and Chaminade and Vang, forthcoming).

The literature on clusters establishes that clustering generates externalities in terms of cheapest access to production factors (static externalities) as well as enhancing learning and innovation (dynamic externalities) through interactive learning. Several studies show that SMEs external relations are more confined to the cluster than those of large firms (Cooke and Morgan 1998, Asheim et al. 2003). For this reason, clusters have been considered as an adequate tool for development of SMEs and, as such, have been widely adopted as a development tool by regional governments and international organizations (such as UNIDO, World Bank).

Cluster policies targeting SMEs performance can be conceptualised as tools supporting the exploration of potential cluster effects for SMEs in ways that account for industry and cluster specificities. Cluster-based policy has proved to be a challenging way of assisting firms in developing countries to move up in the value or commodity chain as opposed to maintaining a position as dependent subcontractors (as the experience of the first and second generation of new industrialized countries attests).

While the cluster approach is sensitive to SMEs, innovation policy in developing countries tend to focus on large firms involved in high-tech industriesⁱ, ignoring the needs of SMEs outside these industries and subsequently failing to facilitate the realization of their innovative potential. With noble exceptions innovation policies seem still in its infant stages when it comes to using the cluster approach as an instrument to support innovation in developing countries, especially in clustered SMEs (Chaminade and Vang, forthcoming). The SMEs innovative potential is linked to their ability to exploit local clustering-effects (i.e. local linkages and interactive learning). Exploiting this potential is especially important for policy-makers since clustered SMEs outside high-tech industries constitute the backbone of the economy in developing countries (Clarysse and Uytterhaegen 1999)ⁱⁱ.

Furthermore, scholars and policy makers using the cluster approach seem to subscribe to a *best practice-approach* applying the same policy measures across industries and institutions, not providing a systematic analysis of industry and institutional specificities. This is evident in the cluster tools developed by international organizations such as UNIDO. Even when industry differences are considered in the analysis of clusters in developing countries -for example in the upgrading strategies of different clusters (Giuliani et al 2005)-, no account is made on the factors underpinning those differences and their policy implications.

This paper aims at providing a systematic account of innovation oriented cluster policies that takes industry and institutional specificities into account (the 'accent' is more on industry specificities than on institutional particularities). In this sense we engage in the recent and open discussion on clusters in developing countries by a) moving beyond the *best practise-approach* to innovation and cluster policy and discuss cluster-based policies to support innovation in SMEs taking into account the specific industry dynamics b) providing a framework to discuss the role of clusters in supporting upgrading and interactive learning as a function of human capital and social capital, c) expanding the geographical coverage of recent studies focused on Latin America (Giuliani et al 2005) to Asian countries.

This triple goal is attained by critically modifying and applying Pavitt's seminal innovation-based industry classification and Pietrobelli and Rabelotti (2004) typology of clustered SMEs in developing countries. The discussion on innovation oriented cluster policies is delimited to focus on the following core dimensions identified as critical in previous research by the authors: degree of decentralization of decision power with respect to policy development and implementation, the role of public and private research and educational initiatives (i.e. learning and human capital building) and the foundation for interactive learning/linkages between firms (i.e. social capital).

The remainder of the paper is structured as follows. In the next section we introduce the theoretical framework. Taking into account the localized nature of SMEs economic activity, our level of analysis is the cluster. We provide a general introduction on the concept of clusters and discuss the role of clusters as facilitators of interactive learning and the role of human capital and social capital in that learning process. Then we turn to the empirical section where special attention is paid to the

four cases. Finally, we turn to drawing general conclusions on innovation policies for SMEs that account for industrial differences.

2. The use of clusters as a development tool

2.1. On the concept of cluster

This section introduces the concept of cluster and relates it to current discussion on the use of clusters as a policy tool for enhancing local SMEs innovation capabilities. The concept of cluster has been used with different connotations in the literature (Martin and Sunley, 2003), to refer to both industrial agglomerations (industrial systems) (Porter 1998, OECD 1999, 2001) and to regionally bounded economic activity (regional system)ⁱⁱⁱ. In this paper we define cluster as geographical concentration of companies in similar or related economic activities and their supporting knowledge organisations.

The relevance of clustering to enhance SMEs innovative performance has received increasing attention over recent years both among academics, consultants and policy makers. The success in the nineties of the so-called third Italy (Piore and Sabel, 1984, Beccatini), Baden Württemberg (Stabel, 1996), Silicon Valley (Saxenian, 1994, Cohen and Fields 1998) and Hollywood (Scott, 1999) turned the attention of researchers, consultants and policy makers towards conceptualizing clusters as engines for stimulating innovative (i.e. radical and incremental) behavior among the clustered SMEs.

The success of clusters in the developed world diffused rapidly to developing countries awakening the interest of scholars, practitioners and policy makers. While scholars have tried to unfold the specific dynamics of clusters in developing regions such as Asia or Latin America (Albu 1997, Bair and Gereffi, 2001; Bitran 2004, Bell and Albu, 1999, Giuliani 2004, Giuliani and Bell 2005, Humphrey, 1995, Lall, 2001, Nadvi and Schmitz, 1999, Pietrobelli and Rabellotti 2004; Rabellotti, 1999, Schmitz, 1999), international organizations such as the United Nations (UNIDO) and the OECD adopted the cluster as a policy and development tool (OECD, 1999 and 2001 and UNIDO 1997 and 2004).

Generally speaking, clusters in developing countries differ from those of the developed world - and certainly from the most well-functioning clusters in the developed countries - at least in three aspects: their growth dynamics (exogenous versus endogenous), their organizational set up as well as their geographical distribution. In the developing world, the dynamics of the cluster are strongly determined by the presence of Trans-national Corporations (TNCs) or the access to international buyers who determine the scope of change in the cluster. In this sense, clusters in developing countries are externally driven. This strong presence of TNCs determines to a greater extent the organization of the cluster. Most clusters in developing countries can be conceptualised as so-called Satellite clusters i.e. clusters of SMEs agglomerating in sub-national areas with firms involved in similar and related industrial activities and dominated by transnational corporations (Markussen, 1994).

The importance of well-functioning clusters for SMEs innovative performance has long been recognized. Innovation is the result of an interactive learning process (lundvall, 1992). It is a socially embedded phenomenon, deeply rooted in the relationships between the firm and its environment. Firms located in industrial districts and clusters can 'plug into' the localized knowledge externalities, specialized labor markets and dedicated institutional support system and use these resources for maintaining an innovation-based competitive advantage. Physical co-location

facilitates face-to-face interaction and thus eases the development of shared visions, culture and cognitive mindsets which make the transfer of tacit and codified knowledge among firms in general but SMEs in particular. Kaufman and Todtling (2002) argue that one of the reasons for this is that SMEs are more dependent on tacit knowledge and less capable of searching for and using codified knowledge than TNCs which forces them to rely more on personal ways of transferring (tacit) knowledge and on learning-by-doing and –interacting (i.e. linkages). Especially, tacit knowledge is important because of the uncertainty involved in generating innovations. However, as we will argue in the following sections, not all clusters in developing countries have managed to support interactive learning and innovation between firms (i.e. TNCs and SMEs and SMEs with other SMEs) and between SMEs and knowledge providers (i.e. research institutions). So, what is needed to enhance interactive learning in industrial clusters?

2.2. Clusters as facilitators of interactive learning in developing countries

The extent to which SMEs can learn through the interaction with the local environment is a function of their absorptive capacity (Cohen and Levinthal, 1990) i.e. the ability to utilise available information and the information and knowledge that comes from interaction with users or from knowledge providers (i.e. research institutions). Absorptive capacity is considered as a dynamic capability (capability because it refer to the skills and routines (Nelson and Winter 1982) that allow SMEs to take advantage of knowledge and information available in their environment, to process it and to commercialize it. Central to building absorptive capacity is the accumulation of human capital and other forms of knowledge. Firms need to have the necessary human capital to identify, acquire and transform the knowledge required for innovation.

The importance of *Human capital* (and knowledge provision) has largely be considered in development studies (Romer, 1990) and, certainly, in relation to innovation studies. It refers to the skills, education, health, and training of individuals' (Gary Becker, 1998, p. 1). One of the most important drawbacks of developing countries is the poor supply of qualified general and subsequently industry specific human capital^{IV}. The lack of basic education is constraining the acquisition of firms and industry specific knowledge which is a prerequisite for innovative activities. This is especially so for SMEs, as Kaufmann and Todlingdt (2002) point out, SMEs need to use the human resources more intensively than large firms in their innovation process. But as a consequence of the poorly developed educational system SMEs in Asian countries have to rely on employing a significant portion of poor and low-skill workforce (Das 2003).

In SMEs competencies when it comes to incremental improvement, reorganization of production processes or cultivating craftsmanship knowledge are highly limited. This means that SMEs have a limited prior knowledge of modern production, thus only limited absorptive capacity facing quite severe challenges when building the absorptive capacity. This leads to suggesting that general human capital building and training targeting particular industry needs (and not yet developed in the particular cluster) is needed to stimulate the SMEs innovative performance.

The human capital literature has not paid sufficient attention to **knowledge provision** not explicitly linked to formal education (i.e. the provision of knowledge

products from research labs, technical institutes, etc) despite the documented the importance these knowledge providers in the development of firms (Laursen and Salter 2004, Chaminade and Vang, forthcoming, Lundvall 1992) - again contingent on the industry. Knowledge providers can be directly involved in developing relevant technologies for the firms (applied technological knowledge), generating new ideas and products, and even providing technical training. In the context of developing countries knowledge providers can thus be engaged in knowledge creating activities targeting the industry and/or SMEs needs with the aim of reducing their dependency on TNCs as solve sources of knowledge and technology;

Social capital (and the related concept as trust) can be translated to the glue that underpins interactive learning (thus to diffusion of knowledge). Following the World Bank “Social capital refers to the institutions, relationships, and norms that shape the quality and quantity of a society's social interactions... Social capital is not just the sum of the institutions which underpin a society – it is the glue that holds them together” (World Bank 1998). Contrary to envisioned by standard economists economic interaction is not primarily a market-based exchange of (tangible) goods by anonymous agents regulated by a complete contract (in the context of efficient contract enforcement). On the contrary, exchange relies on incomplete contracts either due to the lack of possibilities for creating complete contracts, because of the disadvantages in terms of a low degree of flexibility built into complete contracts, or because of inefficient contract enforcement, depending on the mutual trust of the partners involved in the transaction. Unless there is a high degree of social capital cooperation, communication and thus interactive learning is limited (Nooteboom, 2000). In short, absence of social capital in turn reduces the local firms prospects of getting access to important knowledge, knowledge sharing and interactive learning and hence from entering a virtuous development circle.

Clusters facilitate interactive learning when they support the acquisition and transfer of knowledge (human capital and knowledge provision and social capital). In line with this reasoning the policies should target the interactive learning between the firms in the cluster (including both SMEs and TNCs) and the creation of the relevant bodies for providing the relevant knowledge for the industries in question. However, the strategies and types of knowledge acquisition are contingent to the industry (Laursen and Salter 2004). Therefore, innovation and learning processes differ significantly across industries the SMEs are involved in (Pavitt 1984, Asheim, Coenen et al. 2003; Asheim and Gertler 2004, Tunzelmann and Acha 2004). For this reason, when analysing innovation and interactive learning in clusters it is necessary to distinguish between different types of industries.

3. Clusters in the Asian context

Following Giuliani et al. (2005) we propose four categories of clustered SMEs representing the majority of industries in developing countries: traditional manufacturing, resource-based industries, complex product systems and specialized suppliers. A summary of the main characteristics of each of the four industries is included in Table 2. Previous studies (Chaminade and Vang, forthcoming, Giuliani, 2005; Pietrobello and Rabelotti, 2004) have proven that this typology is useful for systematically identifying different patterns of innovative behavior in clustered SMEs. Traditional manufacturing and natural resources-based industries are the most numerous in most Asian countries (Dhungana 2003) as table 1 shows^v. Food and beverages and Textiles are the most important industries in terms of employment and

added value in manufacturing at least in India, Indonesia, Philippines, China, Sri Lanka and Thailand. Only some of the most advanced economies of the region (Korea and Singapore) are not so dependent on these two industries. The economic weight of the traditional manufacturing and natural-resources based industries in the area justify a deeper analysis of the innovation patterns in these two types of industries, mainly dominated by SMEs. For the most advanced countries in the region such as Singapore, Korea and (some parts of) India the picture is somewhat different with a clear dominance of specialized suppliers (such as IT manufacturers or software suppliers) and in the case of Thailand or Korea, the production of motor vehicles.

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In this paper, we will investigate the extent to which clusters in Asia facilitate interactive learning discussing industrial differences and how policy makers might facilitate interactive learning in clustered SMEs. We will analyse the Jepara furniture cluster as an example of a traditional industry in Asia. The flower industry in Taiwan will be used to illustrate the cluster dynamics and innovation strategies of a natural resource-based industry. The Thai automotive industry will be used to exemplify a Complex Product System (CoPS) cluster while the Bangalore IT cluster will reveal the innovation patterns of a specialized supplier. A comparison of the 4 clusters is included in Table 2.

3.1. Traditional manufacturing – The Jepara furniture cluster (Java, Indonesia)

Indonesia has a very long tradition of clusters of SMEs around similar activities. Craft industries are usually geographically concentrated, emulating ancient guilds. This is also the case of the furniture cluster in Jepara.

The Jepara furniture cluster in Java, Indonesia is a large cluster. In the mid nineties the cluster comprised more than 2000 small enterprises and 100 large and medium ones and employing over 40,000 permanent workers (Sandee et al. 1998). About 70 percent of the cluster production goes to international markets, and the rest to domestic markets. Domestic firms account for 75% of the exports while foreign firms are only responsible for 25 per cent (Berry et al 2002).

Traditionally SMEs in the cluster have focused on the domestic market, where quality standards were low and requirements in terms of design were often not fitting the taste of the international customer. The situation changed in the mid eighties, when the government sponsored the participation of Java furniture producers in an international fair in Bali which raised the interest of international buyers in the local production.

Since then, the cluster has been dominated by large international buyers (IKEA is one example of them) who “translate” the demands of the final international customer to the local producers. The indigenous SMEs have followed two types of strategies to access the global market (Loebis and Schmitz 2005): i) reduce costs (low salaries, illegal raw materials, avoid taxes) or ii) compete by innovating in processes and products. The later strategy has implied the introduction of new managerial and organizational changes, including the compliance with international quality and environmental standards. These indigenous SMEs and large firms have privileged access to information and knowledge from the international buyer.

Human Capital and the provision of knowledge: For those SMEs with ties with international buyers, knowledge creation is basically through apprenticeship and learning by doing in general. There are a limited number of very skilled craftsmen, who are employed by joint ventures of SMEs or larger foreign firms (Sandee et al.

1998). Most SMEs are family based. The father of the family is usually the owner and manager. His knowledge is often limited to technical knowledge about furniture crafting; managerial and marketing skills are often lacking, which seriously limits the absorptive capacity of the firm.

In some cases, the employment of expatriates has been a mechanism to acquire technological capability in the rattan firms. Foreign immigrants have better access to market, technology and financing sources (Supratikno 2002 cf Tambunan 2005). Knowledge on customer tastes, technology and access to financial resources might be transferred through social ties. Usually the different members of the family of expatriates are the first one accessing this knowledge.

Social capital and networks: Joint action among producers is well developed. Often members of the same large family own different SMEs in the cluster. Social and family ties are very strong and, as we shall discuss, explain the success in collective action. Small firms participate in networks that share workers, equipment and market channels (Burger et al 2001). These networks of SMEs are usually linked to a large firm or trader that acts as a broker between the group of SMEs and the large international buyers. This later form of relation is too weak and indirect to sustain learning by interaction.

When SMEs collaborate with large firms is usually as subcontractors, although there are some cases of joint-ventures between a local firm and a foreign enterprise. Subcontracting has been crucial to harness traditional skills for export production. Subcontracting is often based on social capital and as identified by Berry et al (2002) often based on kinship, friendship or former business contacts.

The furniture industry is customer driven. User-producer interaction is a very important source of innovation. However, many firms in the cluster do not have direct access to their customers. Large firms in the cluster benefit from information received from the international buyers, with whom they relate directly. SMEs, on the other hand, usually do not have access to the international buyer directly but through traders that connect many small firms with international buyers. Their access to information on new designs, new technologies, etc is very limited. Their main mode of learning is learning by doing and due to the close interaction some imitating also exists (Loebis and Schmitz, 2005), hence new techniques and designs spill over locally.

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3.2. Natural resource-based - The Floral industry in Taiwan

As a province of China formally speaking, and taking into account their limited territory Taiwan can be considered to be in itself a region with complete *de facto* political autonomy from mainland China^{vi}. Taiwan floral industry has experienced a fast growth over the last decade due to a strong domestic market and the increases in cut flower exports, especially to Japan and the US (Tsai 2001). Today Taiwan competes in international markets in the same segment with Thailand or China.

The Taiwanese floral cluster is clearly dominated by SMEs. Traditionally, there has been a clear division of labor between the production and commercialization of flowers. Producers are small in size (usually the average farm size per family is one hectare) due to the high cost of the land. Producer SMEs tend to cluster geographically to be able to access to machinery and greenhouse facilities shared by different producers (Tsai 2001). The knowledge required for the production is very specific and operational and most producers do not have any marketing skills.

Innovation of the flower industry in Taiwan, especially the orchid production is clearly linked to the investments in biotechnology and the linkages with the

knowledge providers (universities and research centers). Until very recently the Taiwanese producers relied only on 'natural' species which could be produced on most Asian countries, hence not a source of long term competitiveness. Now they are experimenting with non-natural varieties which display particular aesthetic features and longer durability. These are the outcome of an emerging collaboration between producers and the bio-tech institutes that has provided and provides opportunities for developing new species (e.g. like the blue orchid). Realizing the full potential of this collaboration is however contingent to establishing the right links between the producers, the researchers and the final markets (through the marketing channels). Currently collective action is frequent but limited to one activity of the value chain (production or marketing) and hence appears fragmented. Orchids are rather easily copied (imitated) but since Taiwan has and is developing specialized knowledge and related support institutions within these fields Taiwan can engage in constant innovation and protect themselves against imitators and hence sustain their long term competitiveness. SMEs are responsible for the production and, to some extent for the marketing of the product. Most of the activities are based on indigenous Taiwanese firms and TNCs have a limited role only.

Human capital and knowledge provision: Taiwan government has made a considerable effort increasing the number of students in secondary and tertiary education (Veselka 2005). In 2000 the percentage of the population with higher education was 88, 5 %. General competences are crucial for the upgrading process which places high demands for general skills on the producers and the knowledge providers.

In the Taiwanese flower cluster there is a great component of formal training and, although it has not been documented, we expect that there is also a great flow of information between the farmers about production techniques and intense learning by doing. The Taiwanese Council of Agriculture supports different training program in agricultural product marketing targeted specially to young farmers (Taiwan Council of Agriculture, 2003).

The innovation strategy chosen in the cluster (via biotech developments) requires a great absorptive capacity by the indigenous SMEs. Not only they need to know their product and how to optimize the production, but they need to have some minimal technical knowledge to be able to interact with the researchers in the biotechnology firms.

Social capital and networks: Small businesses form tight networks encompassing personal and business relationships. These networks *guanxi* are based on traditional Chinese social values where human relationships are closely linked to families, relatives, friends, classmates, and previous colleagues (Liu, 1998) but segmented along 'ethnic' lines (e.g. Hakka, Mainlander and Taiwanese). Tight networks seem to be strong within one group of actors (producers, distributors or researchers) but weak between agents.

The distribution of flowers to the domestic and international markets is in the hands of cooperatives and cooperative marketing teams who also set the quality standards that the farmers should follow (Hsieh 2001). The marketing channel is dominated by four wholesale companies that use the auction system providing on real time the information on the market on line. The majority of producers do not have any interaction with the final customer. Most innovations are technology driven (and not customer driven) and relate to better seeds and new varieties of plants (product innovation) or more efficient forms of cultivating (and transporting) the flowers to the final market (process innovation).

3.3. Complex product systems (CoPS) - Thailand's Automobile clusters

The Thai automobile industry – occasionally referred to as the Detroit of Asia – is considered to be the most important hub for automotive production in Asia (Techakanont and Takahashi 2004, Lecler 2002) and has until recently – at least – been considered a successful case; why will be come clear below.

The Thai automobile industry is constituted by several clusters. Initially the production was located in a cluster located close to Bangkok. Diseconomies of agglomeration (ranging from increased wages, scarcity of workers to traffic congestion) have resulted in the emergence of new clusters scattered around Thailand where Chonburi, Bangkok, Rayong, Samutprakarn and Pathumthani are among the most important ones (for details on the differences in their internal specialization, see Samat 2004). Thai automotive clusters are centred on TNCs. Most major assemblers are present in Thailand^{vii}. Around 113,512 are employed in the Industry where SME accounts for approximately 50% percent of the employees (Samat 2004). The indigenous Thai firms are mainly SMEs that act as second and third tier subcontractors. The first tier consists of more than 700 companies where 40% of these are owned by TNCs. Second tier suppliers are around 1000 (Samat 2004).

The clusters are clearly dominated by TNC who control and define the scope of the innovation in the sector. The role of the SMEs in the clusters has been greatly affected by the national policy which changed significantly after the WTO/GATT agreement. Until recently the Thai SMEs played a significant role as first or second tier subcontractors for the TNCs. Formal policies from the Thai central government stipulated that TNCs locating in Thailand had to guarantee a certain local content in the production. TNC were obliged to link up with local manufacturers. However, in the last years have the Thai SMEs have either been reduced to third or forth tier subcontractors, been bought up or gone bankrupt.^{viii} This can be attributed to the general 'deregulation' enforced by WTO/GATT. The Thai government interpreted the WTO/GATT agreement as entailing the dismantlement of the "local content requirement" and a general opening of the economy to FDI. As a result TNC subsidiaries established production in the Thai clusters and out competed the Thai SMEs. Moreover, new strategies among the major assemblers on product innovations place a new demand on the local subcontractors. The assemblers have started to develop local models. To attain this goal the SMEs have to become involved in the design process too.

In this context, it is possible to distinguish between two types of SMEs and innovation opportunities: Foreign and joint-venture firms seem to have preferential access to the required technology and resources through their parent companies. For the vast majority of SMEs in the sector, technological improvement is only the result of in-house efforts and the improved experience of employees (Techakanonta and T. Terdudomtham, 2004). Human and organizational capital are the main determinants of the upgrading of these SMEs. Thai firms cannot always be price competitive. If they want to compete Thai firms need to enhance their engineering capabilities, develop design competencies and move up in the value chain. The Thai SMEs have not managed this transformation. Why?

Human capital and knowledge provision: Thai firms did not use the advantage that they enjoyed during the "local content requirement" period to develop their competencies or implement organizational forms supporting product or process innovations. Thai SMEs simply produced parts according to already established production methods, blueprints and – often – based on technology acquired from the

TNC (Techakanont and Takahashi, 2004). The central Thai government did not develop or implement competitiveness oriented policies (the link to decentralization will be elaborated upon below). As a result, most Thai SMEs lack the human capital and organisational ability required to engage in innovation (and upgrading in the global value chain), that is, they lack the required absorptive capacity to acquire technology and knowledge generated elsewhere. In the long run there is a need for a developing the technological (engineering) capabilities based on external technology transfer from TNCs as indigenous technologies are almost none existing^{ix}; additionally there is a need for building competencies within design and testing (Techakanont and Takahashi, 2004).

Social capital in Thai automobile clusters: Compared to other types of clusters where horizontal knowledge spillovers are considered crucial this is not the case for the Thai automobile clusters. Networks are limited to first tier suppliers^x whilst second third-tier suppliers do not connect to the network as they do not meet the quality standards (Sevilla and Soonthornthada, 2000). As an example, only 10 % of the Thai suppliers have ISO 9000, 14000 or 18000. That is, collaboration based on social capital between Thai SMEs is not yet of much relevancy as most Thai SMEs simply do not have the competencies, knowledge and information that can create synergetic relationships.

As the situation is now the Thai have to rely on technology transfer from TNCs. This however is a challenging strategy with few successes (Asheim and Vang, forthcoming, Narula and Marin 2005, Lall and Narula 2004). Only few SMEs receive advice about quality control, maintenance, design drawings for the making of dies or tooling and advice about project management from the assemblers (Techakanonta and Terdudomtham, 2004)

3.4. Specialized suppliers- Bangalore IT cluster

Situated 1000 km from Bombay, in the Karnataka State, Bangalore has become one of the most important IT clusters outside the US to the extent that it is known as “India’s Silicon Valley” (Nadvi, 1995). Bangalore city, with around 1 million inhabitants, is the center of the city-region spread out around Bangalore.

Bangalore houses several high-tech clusters (defense, aeronautics and IT) and is considered to be the scientific and engineering centre of India in terms of research, training and manufacturing. India’s best research university- Indian Institute of Science is based in Bangalore. The easy access to qualified and relatively cheap technical human capital attracted a number of transnational corporations during the nineties. Large firms such as IBM, Motorola, Hewlett-Packard, Siemens, 3M, Texas, etc. located in the area. Despite the weight of the TNC in the Bangalore IT sector, the large majority of firms are small and medium sized enterprises. Only 10-15 percent of the revenues of the sector are from SMEs (NASSCOM, 2005).

The development of this particular city-region is more shaped by the industrial development in the US than local cluster-effects and regional government bodies’ policies. Though it should be stressed that Bangalore's growth until the late 1980s (when the software export boom began) relied on local (largely public sector) investments; Bangalore already had a dense organizational setting; Bangalore was/is the center for advanced science and military research – this was mainly for physical geographical reasons such as air without dust which was needed for military testing - and had a number of good educational institutions already, mainly paid for by the central authorities. Even the government did locate in Bangalore the public telephone company as well as other large state enterprises in high-tech sectors.

As in the Thai Automotive cluster, the dynamics of the IT cluster in Bangalore are dominated by the large transnational corporations located there. It is possible to find two types of SMEs: those tied to a TNC through a subcontracting agreement and a limited number of independent SMEs. Frequently, SMEs undertake task specific job-work for the large client firm who settles the parameters of the production and the final outcome and tightly controls the performance of the SME. For these SMEs, which are the majority, innovation is defined by the large firms and SMEs are only responsible for maintaining quality standards at minimum costs. Innovation is mostly determined by the large firms (Nadvi, 1995, Vang and Overby, forthcoming). Occasionally the SMEs suggest marginal modifications to the large firm, based on their expertise.

Beside this large group of SMEs and networks, it is possible to find some independent SMEs, usually driven by highly qualified people that decided to run their own firm. These firms retain their own design and production capacity and try to position their products in the local market and to a lesser extent, abroad. Innovation is the result of the interaction with the final clients.

Human capital and knowledge provision: The technical side of the knowledge base of the IT industry draws on a combination of technical – engineering -skills. The routine activities basically draw on codified programming skills while the sophisticated tasks draw on a combination of codified programming competencies, firm specific – tacit and quasi-codified - competencies developed through creating customized programs.

Accessing qualified workers is not a problem for the SMEs of this cluster and, in this sense, their capacity to absorb knowledge and technology generated outside the SME (absorptive capacity) is very high. There are several universities, business schools and high schools located in the region that provide the cluster with the required supply of skill labor.

Several studies have documented that during the first phase US-firms mainly outsourced routine IT-services such as maintenance of existing code or reengineering code from one programming language to another to India. The human capital base in Bangalore was characterized by many well-educated engineers that were perfectly capable of undertaking these activities. The skills needed for this were simple IT skills and the Indians undertaking these activities were most often over-qualified.

In recent years Indian firms have to some extent been capable of moving up the global value chain. On the one hand, TNCs adopted a deliberate strategy to modularize and standardize some of their IT processes. This provides the background for the distance work which in turn allowed the Indian firms to maintain a broader knowledge base at home (Parthasarathy, 2004), hence secure better absorptive capacity.

Social capital and networks: Collaboration between SMEs based on social networks is limited in the IT cluster^{xi}, but it exists. Interpersonal networks are based on common schooling and alumni links built around the many technical schools located in the region (Nadvi 1995) as well as on previous working relationships (people that have been working together in the same firm one time or another).

Consortia of SMEs have often been prone to failure due to the competitive tendencies among group members. Evidence suggests that they have been more effective when member firms are complementing each other and not competing. Joint action has often involved marketing of products and seldom the development of a product (Nadvi 1995).

Social capital transcends the regional boundaries in this cluster. The social capital of the Indian transnational community played a crucial role in establishing the IT industry. To get access to orders, capital and more sophisticated knowledge the Indian firms were forced to target transnational corporations. This uncertainty allowed the Indian transnational community, who held important positions in the US firms, to play a significant role in shaping the outsourcing decisions in the US firms

Recently one has witnessed a significant growth in interaction between Bangalore firms and US and European firms as well as a diversification of the profiles of firms investing in Bangalore. The Bangalore firms have developed a certain degree of autonomy from the lead firms in US and Europe. The autonomy is a function of investments in human capital and new managerial strategies; hence they can now provide all types of services from the highest end of the value chain to the bottom end. This has allowed them to move up the global value chain. Part of this process has been facilitated by increased cluster-effect and spin offs from the different universities located in Bangalore. However, the Indian firms did only to a limited extent engage in interactive learning compared to more bustling IT cluster such as Silicon Valley. While the social capital was efficiently in creating the initial development phase it has proven less efficient in stimulating collaboration between different Indian firms; especially Indian firms outside the boundaries of the networks (i.e. not an inclusive social capital structure)

4. Innovation Policy for SMEs – learning from the cases

This section aims at drawing lessons for the design and implementation of innovation policies to support clusters of Asian SMEs. The lessons are based on the cases; hence we do not suggest they can be automatically applied to other clusters. Instead they serve the purpose of illustrating the need for diversity of cluster-based innovation policies supporting SMEs. We critically use the cluster framework to discuss how the soft infrastructure of the cluster (human capital and social capital) and their systemic propensities might influence the innovative performance of the Asian SMEs located in the cluster; and how can the government selectively invest in the weak and critical nodes of the cluster to support interactive learning in the cluster by enhancing SMEs innovative capabilities and facilitating networking and social interaction.

Innovation policies usually follow best practice models based on high-tech clusters located in high performing regions and only a small number of SMEs benefit from these policy measures. In this paper we argue that when designing innovation policy for SMEs, policy makers need to take into account the different dynamics of clusters of SMEs. The cases illustrate how traditional industries or resource-based industries that tend to be ignored by innovation (technology) policies in Asia, have significant potential in terms of innovation. Hence, these cases illustrate that traditional industries remain potential platforms for upgrading in developing countries (Mylteka and Farinelli 2000) but also that policy makers need to adopt a broader perspective on the innovation processes in these industries. Hence, one of the first conclusions to draw from the cases is that there is a need for innovation policies targeting the particular needs of SMEs operating in different industries. Unless such measures are taken SMEs are not likely to engage in noteworthy innovations or interactive learning in general. Subsequently, the SMEs will at best maintain their role as low cost subcontractors to TNC and not exploit their economic potential. In the worst scenario they could even lose their position as subcontractors by being out competed by world players.

The cases also suggest that designing and implementing innovative policies for Asian SMEs requires an approach that pays attention to the provision of knowledge and knowledge exchange mechanisms, notably social capital and networks. Only when these two elements are in place, SMEs can engage in interactive learning and, as a consequence, innovation.

Contrary to what the existing literature on clusters sustain, the cases also demonstrate that clusters do not always facilitate interactive learning as pre-conditions exist. Notably, the firms need to have absorptive capacity and be engaged in networks that facilitate knowledge exchange. Policy makers might intervene when these two pre-conditions are not in place, that is, when systemic failures occur (Chaminade and Edquist, forthcoming).

Use of the cluster approach for innovation policy

Applying the cluster approach has proven useful as the point of departure for the design of innovation policies to support SMEs in Asian countries. In contrast to other more atomistic approaches working with the same variables but in isolation, the cluster approach considers the links and dependencies of the different institutions and organizations. Thinking “systemic” allows selective interventions in the weakest nodes in the system and/or on the most critical nodes. And selectivity is crucial for developing countries where financial resources are extremely scarce. This in turn can help policy makers to avoid policy interventions focusing on just one variable of the system which might lead to decreasing returns unless supported by complementary investments. As an example, additional investment in human capital in the Bangalore region will not pay off unless combined by demand side investments.

The cases tend to hold the general claim in the cluster literature arguing in favor of decentralized decision-making structures. This is supported by the behavioral pattern of the Asian SMEs whose interactions tend to be embedded locally. Highly centralized government bodies tend to lack the local knowledge and base their interventions on aggregated data that often fails to capture both local and industry specificities. Thus the particular needs of the local SMEs, morphology of local networks and so forth are ignored. For these reasons, centralized governments might even intervene in counterproductive ways. As mentioned earlier, this calls for a decentralized decision-making structure. However, there is a need to a) highlight the still relevant role of the centralized government agencies and b) a need to argue against a ‘one-fits all’ territorial decision-making structure.

The centralized governmental bodies need to define the general formal rules of the game (e.g. formal law, working standards) to avoid that regions use national policies to engage in a cost-based competition against each other. Decentralization of such policies is likely to hamper the innovation performance of SMEs.

The morphology of the decentralized decision-making structure is also contingent on the industry and institutional setting as the cases illustrate. It can take two forms: a) all major decision rights can (or should be) be allocated to the regional governments or b) central government bodies have (or should have) located local government branches with a high degree of autonomy in the relevant regions and clusters. In the latter case there is an additional need to pay attention to which part of the policy process needs to be decentralized (e.g. design and/or implementation)

While it is still too early to come up with a rule of thumb on when the first or second type of decentralized decision-making structure should be applied the cases seem to suggest the following. First, that industries relying on highly localized idiosyncratic knowledge tend to benefit most from a decision-making structure based on regional government bodies. The Jepara furniture cluster can illustrate this. The case points to how the regional government has been effective in identifying some of the weakest and most crucial nodes in the regional innovation system with respect to the internationalization of the clustered SMEs. Secondly, industries relying on global standards and/or high capital entry-barriers tend to be best facilitated by the central government premises located in the region. This comes out most clearly in the Bangalore IT software case where the central government’s ISS policies have been important in the development of the cluster and the educational institutions function well despite being under central rule. The Thai automobile case also suggests the need for a strategy based on decentralization of central government bodies as scale economies benefit from a centrally coordinated strategy.

Support of interactive learning in the cluster: facilitating knowledge acquisition and exchange

The appropriate territorial decision-making structure assures the provision of information on weak nodes and complementarities in the cluster and thus on where and how to intervene with respect to the provision of human and social capital and networks. The industry specific cluster policies can draw on a palette of different supply and/or demand side policies. Among these the can focus on providing timely and qualified human resources, supporting the creation of social capital and effective networks between SMEs and TNCs, supplying physical infrastructure, business support services and financial capital and supporting access to markets

Industry and institutional contingencies dictate what are the areas (hard and soft infrastructure) in which a governmental intervention is most needed in the cluster e.g. investments in human capital, or scientific infrastructure, etc).

Before presenting the case specificities it should be noted that across all the cases the Asian SMEs innovative performance tend to be constrained by lack of managerial skills in the broadest sense, especially of the manager or owner of the firm. Intervention in this area seems to be critical for all Asian industries considered in the study.

In traditional industries as illustrated by the Jepara furniture cluster in Indonesia the major weakness in for the SMEs in the cluster is upgrading the local craftsmanship to meet international demands. This can be solved partly if local manufacturers can link up to international buyers and international markets directly. This is possible when they are price competitive, provide the right design, comply with required international standards (environmental mainly) and are known actors on the international market. For SMEs not possessing the skills needed for harvesting the benefits from collaborating directly or indirectly with international buyers the government needs to provide information on international demands, standards and international markets and facilitate the access to international markets (for example, supporting the presence of local SMEs in international trade fairs). However, providing information is only one variable in the equation. SMEs also need to change their productive competences according to the demands of the global markets. Regional governments can facilitate the acquisition of new competences through training tailored to the specificities of the local industry and the global markets. This will lead to an improvement in the absorptive capacity of the SME.

In resource-based industries the weakest node constraining SMEs innovative performance is the lack of competencies allowing SMEs to move up in the global value chain. Success stories like the wine and salmon production in Chile or the Taiwan case in our paper show that this can be attained by linking the industry to biotechnology research. Central in the policy interventions is the collaboration between the knowledge providers (universities and research institutions) and the producers as well as the provision of hard scientific infrastructure and qualified human capital. This type of collaboration can facilitate, for example, the invention of new species, more resistant ones, or similar. Local producers can then enter international market with a knowledge intensive new product, creating a new niche market. This is clearly the strategy of Taiwan, which attempts to become a world leader in orchid production. The government has a crucial role to play as this strategy requires significant investments in research facilities that exceed SMEs capacity. But hard infrastructure is only one part of the system. The linkages between the knowledge infrastructure (biotech labs for example), the producers and the markets

need to be in place and SMEs need to have the knowledge to understand the possibilities of the new products (absorptive capacity).

The policies in CoPS, like the Thai automotive clusters illustrate, are highly dependent on the TNCs willingness to provide assistance on technological upgrading and building of design competencies as this is beyond the scope of the indigenous SMEs. When TNCs provide this type of information/assistance it is mainly to first tier suppliers. SMEs do not play a significant role as first tier suppliers as most indigenous SMEs do not comply with the international quality standards required by the TNC. The cases illustrate that at least two strategies are possible. One is to regulate the relationship between the TNC and the SME, for example, forcing the TNC to subcontract with indigenous SMEs. While this might seem a viable solution in the short term, it does not provide the right incentives for the SMEs to acquire new competences, as the Thai case shows. The second strategy is for the Government to focus directly on improving the competences of the indigenous SMEs. This calls for government intervention focusing on providing the needed industry specific technical and managerial training and the development of indigenous technologies.

Finally the policies targeting specialized supplier as illustrated by the Bangalore case initially consists in building the required human capital level engage in cost-based collaboration with TNCs. One that this level is attained the largest problem that the SMEs in these types of industries in Asia are currently facing is getting the high-value assignments that would allow them position in higher parts of the value chain. While the SMEs might have the formally needed competencies for undertaking these activities, TNCs do know or do not trust yet the ability of the indigenous SMEs to undertake these activities. This prevents them from transforming their formal competencies into 'real' competencies; this transformation requires user-producer interaction. This problem is central as the SMEs cannot rely on localized lead users. In parallel knowledge tend not to be distributed within the clusters of co-located firms. Thus after initial phases with investments in human capital public interventions should focus on public procurements allowing where the public government bodies functions as lead users (lead users demanding local interaction).

This paper has contributed to the current discussion of innovation policies in Asia in many ways. First, by providing an analytical framework to study interactive learning in clustered SMEs. Second, by particularizing the analysis to the four most common clusters of SMEs in Asia, identifying some general patterns within the cluster and the main differences across clusters. And finally, by providing some guidance to policy makers on how to intervene support these clusters with the provision of soft infrastructure (human capital and social capital) in the cluster.

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Tables and figures

Table 1. Economic Importance of SMEs and distribution of employment and value added among manufacturing sectors in a selection of Asian countries (1)

Country	Economic relevance of SMEs in the country	ISIC sector	% employment	% manufacturing added value
India	95% of the industrial establishments 80% of employment - 40% of industrial output, 35% of the manufacturing sector, 40% of exports and 7% of NDP	Food and beverages	16,1	12,2
		Textiles	17,1	12,4
		Chemical and chemical products	9,6	15,7
Indonesia	70-90% of establishments 20% of the GDP	Food and beverages	13,9	13,6
		Textiles	15,7	12,6
		Tobacco products	6,0	8,9
Philippines	99 % of enterprises 45% of employment 28% of the value added in the manufacturing sector	Food and beverages	16,8	29,8
		Chemical and chemical products	5,0	12,0
		Coke, refined petroleum products	0,2	9,7
Korea	70 % of employment 46% of gross output 47 % of value added	Radio, TV and communication equip.	9,7	16,2
		Chemical and chemical products	5,4	9,5
		Motor vehicles, trailers	8,0	8,7
Singapore	40% of the manufacturing production 25% of the value added in manufacturing	Office and computing machinery	12,6	22,5
		Radio, TV and communication equipment	17,4	19,4
		Chemical and chemical products	6,4	18,5
China	n.a.	Chemical and chemical products	11,1	12,0
		Food and beverages	8,2	10,2
		Basic metals	8,3	9,0
Thailand	98% of the establishments 70 % of industrial employment 4,7 % of added value in manufacturing	Food and beverages	19,0	25,4
		Motor vehicles, trailers	3,9	10,8
		Non-metallic mineral products	6,4	8,6

(1) Total added value of manufacturing= 100. Three most important sectors according to added value.
Source: UNIDO, International Yearbook of Industrial Statistics, 2002 taken from (Das 2003) and (Dhungana 2003)

Table 2. Comparison of the Asian cases

	Traditional Jejara cluster	Resource-based Taiwan flower industry	CoPS Automotive Thailand	Specialized suppliers Software Bangalore
Main characteristics of the Industry (1)	Process innovation mainly and small incremental product innovation. Clustering facilitates organisational innovation. Most new techniques originate from machinery and chemical industries. Opportunity for technological accumulation is focused on improvements and modifications in production methods and associated inputs, and on product design. Competition based on costs. Information flows through informal channels facilitated by the local cohesion within the cluster as well as a result of the rotation of workers among the firms in the cluster.	Importance of basic and applied research lead by public research institutes. Most innovation is generated by suppliers (machinery, seeds, chemicals, etc) or is the result of the cooperation with scientific institutions. Increasing importance of international sanitary and quality standards and of patents. In some cases, upgrading is the result of joint technology development and coordinated actions between firms, business associations, universities and other actors. In some others, TNC provide the technology and knowledge required for the upgrading of the local SMEs	Technological accumulation is generated by the design, building and operation of complex production systems or products. Process and product technologies develop incrementally (modular production systems). Local SMEs are usually required to comply with international quality standards in order to participate in the network. Large assembler firms usually determine the scope of change of the local network of subcontractors. Externalities for geographical concentration are scarce, as both the leader firm and the assembler operate globally. Most knowledge needed in the production process is codified.	Often small firms. Important user-producer interactions. Learning from advanced users. High in-house R&D for development of cutting edge technologies. SMEs in this category tend to concentrate geographically to gain access to the labour market and the consumers. Formal joint cooperation between firms is limited. Technological innovation is product innovation although upgrading is also the result of non-technological innovation such as joint marketing initiatives or changes in the organisation. Mobility of human resources among the different firms is an important channel for knowledge diffusion across the cluster
Specific cluster features	About 2000 SMEs Production goes to international markets	Production dominated by small farms (1 ha per family)	Strongly dominated by TNC assemblers. Local SMEs are usually 2 nd and 3 rd tier, with very limited access to knowledge and technology.	Cluster with strong presence of multinational firms but dominated by SMEs.
Human Capital	Craft industry. Knowledge acquisition is by learning by doing. There are a limited number of very qualified human resources that are shared by several SMEs and large firms. Policy makers can support the transfer of this knowledge. Managerial and marketing skills are needed.	Knowledge is very fragmented in three groups. Producers only know about production techniques, but nothing about the market. Marketing of the flowers is dominated by "marketing" firms. And innovation in the cluster is driven by advances in biotechnology, with researchers in labs relatively isolated from producers and markets.	Production is dominated by blue collar workers. Competition is based on costs, quality standards and to a lesser extent on <i>just in time</i> . Learning is limited as production is according to blueprints. Upgrading requires formal training in engineering and design.	Firms have easy access to qualified human resources. The region houses an important number of education and training institutions. So the technical skills are ensured. However, managerial and marketing skills could be strengthened.

	Traditional Jejara cluster	Resource-based Taiwan flower industry	CoPS Automotive Thailand	Specialized suppliers Software Bangalore
Social capital & networks	Social capital is strong, based on kinship and family ties. Collective action is common, both to access machinery and to attain economies of scale.	Social capital is strong, based on Chinese values and collective action common. However, networks seem to be confined to one activity (production, research or commercialization).	Social capital is weak. Some initiatives like the Toyota's sponsored Automobile Industry Club only reaches first tiers. Collaboration between the SMEs and collective action is almost inexistent, not even to achieve efficiency based on specialization. Government could support the introduction of quality standards to groups of complementary SMEs.	Social capital is based on the alumni network and the mobility of workers. Collective action exists, specially for marketing purposes and to a lesser extent to share technological knowledge or gain economies of scale. However, collective action has been hampered by fierce competition between the firms. Cooperation is successful when based on specialization. Government could play a role supporting collective initiatives of complementary firms and providing information of the SMEs core business.
Policy	The presence of the government in the cluster has been limited. However, some of the initiatives (like promoting the attendance to international trade fairs) have been very successful. More support for the development of human capital, specially managerial and marketing skills, provision of information on international trends and facilitating direct access to the customer is needed.	Success in this cluster is based on coordination of the different actors (producers, researchers and customers) as well, access to information on international opportunities and trends and the provision of infrastructure (scientific mainly). The government has a great role to play in setting the RIS infrastructure and connecting the relevant actors.	Latest Thai policy towards the sector has been quite detrimental for the SMEs as it eliminated the obligations of TNC to local manufacturers. Government has a role to play in the provision of soft and hard infrastructure for the cluster: qualification of human resources, introduction of quality standards, support of collective action and specialization (upgrading in the value change), encouraging a change of strategy from cost reduction to quality and specialization (knowledge based), and put back the obligations of TNC towards indigenous SMEs.	Government has an important role fomenting collective actions among SMEs in the cluster, focusing on specialization and not competition. Assistance for international trade fairs could facilitate the insertion of these SMEs in international market. Public procurement could also be a powerful incentive for the local SMEs. Finally, upgrading managerial skills to complement the high technical skills is needed.

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- ⁱ Only three percent of the SMEs are targeted by high-tech innovation policies (Clarysse and Uytterhaegen 1999)
- ⁱⁱ In the context of Asia the latter is documented by the stylized fact that SMEs account for one third to two thirds of the turnover of the private sector (OECD 2002), they constitute the majority of the firms and the entrepreneurs (Dhungana 2003) and are responsible for around 80% of the workforce within the industrial sectors (Das 2003) as shown in Table 1.
- ⁱⁱⁱ Malmberg (2003) proposes to clearly distinguish between industrial cluster and regional cluster. From our point of view, such distinction, although valid from a theoretical point of view has limited use in practical terms as cluster refers both to industrial and spatial agglomerations.
- ^{iv} As a proxy for the lack of general human capital one can use illiteracy-rates. And adult illiteracy still reaches the two digits in some countries such as Indonesia and Malaysia (World Bank, 2003). Enrolment in secondary education is around 50%
- ^{iv} while most of the developed world reaches 90-100 per cent and, with the exception of some countries like Korea, the enrolment in tertiary education is between 10-20 per cent.
- ^v It is important to note that these statistics only contain information on manufacturing industries. Services are, therefore, excluded.
- ^{vi} The Taiwanese government has settled the priorities for the economic development of the island, being one of them the biotech sector and its connections with other local industries including the floral industry.
- ^{vii} From Japan: Toyota, Honda, Isuzu, Nissan, Mitsubishi, Hino; US: GM, Chrysler, Ford; Europe: BMW, Volvo, Daimler, Volkswagen, Citron, and Peugeot).
- ^{viii} While the bankruptcy sure was accelerated by the late nineties financial crisis in Asia; this cannot hide the fundamental structural problems the Thai automotive industry faced.
- ^{ix} Unless the Thai government uses RIS policies to develop indigenous capabilities, see below.
- ^x For example one of the consequences of the Japanese leadership was to create several Automobile Industry Cooperative clubs for assemblers and first-tier suppliers.
- ^{xi} Collaboration is scarce in existing products and markets but as XXX show SMEs might collaborate for the creation of new markets and new products (where novel combinations of competences are required) and not that much in existing products and markets.

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